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# Doubled Haploids of American Pima Cotton

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## ABSTRACT

Five boll and six fiber properties were measured for 234 doubled haploids (pure lines) of American Pima cotton (*Gossypium barbadense* L.) grown at Phoenix, Ariz. These doubled haploids were derived from 48 germplasm sources. They are the largest known group of homozygous genotypes in cotton. Each doubled haploid was uniform within, but varied extensively among, genotypes for boll and fiber properties. No unusual or unexpected values or combinations of values were observed. Forty-four of the 234 doubled haploids were grown in replicated performance tests for determining yield, boll, and fiber properties. The complete homozygosity of doubled haploids had no apparent deleterious effects on seedling vigor and plant growth; however, with few exceptions the fiber properties of doubled haploids were inferior to standards in at least one property. The main use of doubled haploids appeared to be the obtaining of homozygous lines from segregating populations in one generation as opposed to several generations required in the plant-to-row method. Large numbers of doubled haploids will have to be screened to obtain those with acceptable yield and fiber quality.



KEYWORDS: *Gossypium barbadense* L., haploid, doubled haploid, homozygosity, boll properties, fiber properties.

# CONTENTS

# DOUBLED HAPLOIDS OF AMERICAN PIMA COTTON

By E. L. Turcotte and Carl V. Feaster[1]

## INTRODUCTION

Haploids are plants with the gametic chromosome number. American Pima cotton (*Gossypium barbadense* L.) haploid plants have 26 single chromosomes instead of the normal 26 pairs. They are sterile due to lack of pollen shedding, have smaller plant parts, and are usually excessively tall as a result of no fruit set.[2]

American Pima cotton haploid plants occur naturally in field plantings. One to three haploids per 25,000 plants is not uncommon. Haploids occur also as one or both members of twin-embryo seed. The frequency of twin embryos is variable depending upon seed source. A line of American Pima cotton has been reported that produces a high frequency of haploids, up to 60 percent of germinated seed, from single-embryo seed.[3] The production of haploids at will in cotton can be accomplished through the use of the semigamy phenomenon.[4] Semigamy is an abnormal type of reproduction in which a sperm nucleus penetrates an egg cell but does not fuse with the egg nucleus. Both nuclei divide independently resulting in $F_1$ plants that are sectored for haploid maternal and paternal tissue.

Doubled haploids are derived by doubling the chromosome number of haploids with the alkaloid colchicine [(*S*)-*N*-(5,6,7,9-tetrahydro-1,2,3,10-tetramethoxy-9-oxobenzo[*a*]heptalen-7-yl)acetamide]. This results in fertility restoration and the production of homozygous lines in one step. The complete homozygosity of these lines had no deleterious effects on seedling vigor or plant growth, making them useful for various variety improvement procedures.[5]

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[1]Research geneticist and research agronomist, respectively, U.S. Department of Agriculture, Agricultural Research Service, Phoenix, Ariz.

[2]Meyer, J. R., and N. Justus. Properties of doubled haploids of cotton. Crop Science 1:462-464. 1961.

[3]Turcotte, E. L., and C. V. Feaster. Haploids: High-frequency production from single-embryo seeds in a line of Pima cotton. Science 140:1407-1408. 1963.

[4]Turcotte, E. L., and Carl V. Feaster. Methods of producing haploids: Semigametic production of cotton haploids. *In* Haploids in higher plants--advances and potentials. K. J. Kasha, University of Guelph, Guelph, Canada. P. 53-64. 1974.

[5]Chaudhari, H. K. The production and performance of doubled haploids of cotton. Bulletin of the Torrey Botanical Club 106:123-130. 1979.

Doubled haploids of American Pima cotton have been grown at Phoenix since 1959. They have been derived from numerous germplasm sources and are a storehouse of stable variability for a wide range of boll and fiber properties. We have used certain of these doubled haploids to test the effect of homozygosity on yield stability,[6] to produce pure lines from male gametes from $F_1$ plants to investigate the feasibility of this procedure to more efficiently isolate superior genotypes,[7] to stabilize the nectariless trait that affects host plant resistance, and to combine in one step sterile cytoplasm and diverse genomes for sterile female parents for hybrid cotton development.

The objectives of this manual are to make available to cotton researchers boll and fiber data from 234 American Pima cotton doubled haploids for which seed is available, and to report yield, boll, and fiber data from seven performance tests involving American Pima doubled haploids.

## MATERIALS AND METHODS

The American Pima cotton haploids reported herein were verified cytologically and/or morphologically. Their chromosome numbers were doubled by application of 0.5, 0.6, 0.75, or 1.0 percent colchicine in a 4.0 percent tragacanth aqueous solution to axillary buds.

Seeds produced on doubled sectors were grown in a greenhouse for an initial seed increase. Subsequent generations of each doubled haploid were grown in the field at Phoenix, Ariz. Seeds were drilled in the field in rows approximately 9 m long with rows 1 m apart. Rows were thinned to approximately one plant per 0.4 m after stands were established. Conventional management practices, including insect control, were used during the growing of the crop each year.

Fifty-boll samples of seedcotton were harvested from each doubled haploid each year it was grown for determination of boll and fiber properties. Boll properties measured were boll size (grams per boll), seeds per boll, seed index (100-seed weight, in grams), percent lint (percentage of seedcotton that is lint), and lint index (weight of lint from 100 seeds). Fiber properties measured were upper-half mean and mean fiber lengths, in millimeters, determined from 1959 through 1963, and 2.5- and 50-percent span fiber lengths, in millimeters, determined from 1964 through 1980; uniformity index (ratio of mean to upper-half mean or 50-percent span length to 2.5-percent span length X 100); $T_1$ fiber strength, in millinewtons per tex; $E_1$ fiber elongation, in percent; and fiber fineness measured on the micronaire and reported in micronaire units (higher readings indicate coarser fiber). Fiber property measurements were made at the ARS Fiber Testing Laboratory at Phoenix. Selfed seed was produced on each doubled haploid each year for maintenance.

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[6] Feaster, C. V., and E. L. Turcotte. Yield stability in doubled haploids of American Pima cotton. Crop Science 13:232-233. 1973.

[7] Turcotte, E. L., and Carl V. Feaster. Comparison of doubled haploids and Pima S-5 in American Pima cotton. *In* The plant genome, D. R. Davies and D. A. Hopwood, editors, John Innes Institute, Norwich, England. P. 248. 1980.

Performance tests of doubled haploids were grown in 1961, 1962, 1963, 1964, 1977, 1978, and 1979 at Phoenix. All tests were planted in randomized complete blocks in rows 1 m apart. The 1961, 1963, and 1964 tests consisted of two-row plots, 12.2 m long, planted in six replications. The 1962 test had one-row plots, 12.2 m long with six replications. The 1977 test had one-row plots, 9 m long with six replications. The 1978 and 1979 tests were planted in one-row plots, 9 m long with seven replications. Plots were thinned to 10 plants per meter after stands were established. Conventional management practices, including insect control, were used in growing the crop each year. Fifty-boll samples from the 1961, 1962, 1963, and 1964 tests and 100-boll samples from the 1977, 1978, and 1979 tests were harvested for determination of the boll and properties described above. Total seedcotton was harvested from each plot for determination of lint yields in kilograms per hectare. A Least Significant Difference (L.S.D.) value was calculated to compare the performance of doubled haploids and check cultivars for each property measured in each test.

## RESULTS AND DISCUSSION

### Doubled Haploid Germplasm

Boll and fiber properties of 234 American Pima cotton doubled haploids, fiber properties for a 'Pima S-2' fiber laboratory standard, and boll and fiber properties for 'Pima S-5', the current commercial cultivar, are presented in table 1.[8] Also included in table 1 is the number of years each doubled haploid was tested. The number of years each doubled haploid was tested must be considered when comparing properties among the doubled haploids.

The haploids from which the 234 doubled haploids were derived were obtained in three ways: 7 were found as one member of twin seedlings, 92 occurred naturally in field nurseries and commercial plantings, and 135 were derived via semigamy. Forty-eight germplasm sources are represented by these 234 doubled haploids. The pedigrees and corresponding doubled haploid identification numbers in each pedigree are shown in table 2.

The doubled haploids listed in table 1 form the basis of the largest known group of homozygous genotypes in cotton. Each doubled haploid is very uniform within, but extensive variability exists among, the genotypes for both boll and fiber property parameters. The ranges in values for the boll and fiber properties tested were as follows: boll size, 4.45 g to 1.53 g; seeds per boll, 24 to 9; seed index, 14.7 g to 10.1 g; percent lint, 37.8 to 24.1; lint index, 7.9 g to 4.5 g; 2.5-percent span fiber length, 38.4 mm to 31.2 mm; 50-percent span fiber length, 19.3 mm to 14.7 mm; $T_1$ fiber strength, 357 mN/tex to 257 mN/tex; $E_1$ fiber elongation, 10.2 to 5.4 percent; and micronaire, 4.77 to 2.72. No unusual values or combinations of values were obtained for the 234 haploids tested.

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[8]All tables are grouped together in the appendix.

Certain doubled haploids listed in table 1 are superior for one or more of the traits measured (table 3).

## Doubled Haploid Performance Tests

Doubled haploid performance tests and check cultivars were grown in 1961, 1962, 1963, 1964, 1977, 1978, and 1979 at Phoenix. The results from these tests are presented in tables 4 through 10, respectively.

In 1961 (table 4), nine doubled haploids and Pima S-2 were compared. Significant differences were detected for each of the traits measured. Doubled haploid No. 4 yielded significantly higher than Pima S-2 but had inferior boll and fiber properties. Doubled haploid No. 17 and Pima S-2 had similar yield and fiber properties.

Eleven doubled haploids and Pima S-2 were compared in 1962 (table 5). Significant differences were detected for all properties measured with three doubled haploids yielding significantly higher than Pima S-2. One of these doubled haploids, No. 30, was derived from Pima S-2. It had similar boll and fiber properties compared with the check except for significantly lower $T_1$ fiber strength, an important deficiency.

Seven doubled haploids and Pima S-2 were compared in 1963 (table 6). Significant differences were detected for all properties measured, except $E_1$ fiber elongation. The four highest yielding entries in the test were doubled haploids derived from Pima S-2. Doubled haploid No. 50 yielded significantly higher than Pima S-2 but had significantly shorter fiber. All the properties of doubled haploid No. 62 were similar to the check.

Two doubled haploids and Pima S-2 were compared in 1964 (table 7). Significant differences were detected for percent lint, lint index, fiber length, and micronaire. The two doubled haploids compared favorably with the check for all traits except percent lint.

Twenty-three of the 25 doubled haploids grown in performance tests from 1961 through 1964 were derived from commercial varieties or advanced experimental stains. These tests showed that doubled haploids from these sources serve best as homozygous representatives of strains from which they were derived. As a group, they are usually deficient in one or more traits, especially lint percent or micronaire.

With the advent of semigamy, allowing the production of cotton haploids at will,[9] the source of doubled haploids was changed to early generation materials. This is reflected in the doubled haploids grown in performance tests in 1977, 1978, and 1979.

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[9] See footnote 4.

In 1977, four doubled haploids derived via semigamy from $F_1$ male gametes of cross 6907, an experimental strain derived from cross 6907, and the commercial cultivar Pima S-5 were grown in a replicated performance test (table 8). Three of the four doubled haploids yielded significantly less than Pima S-5. The boll and fiber properties of the doubled haploids were generally inferior to Pima S-5. Compared with experimental strain 6907-95-8-4, three of the doubled haploids yielded similarly and one yielded significantly less lint. All of the doubled haploids had significantly shorter, weaker, and finer fiber than 6907-95-8-4.

Seven doubled haploids produced via semigamy from $F_1$ male gametes of four crosses and Pima S-5 were grown in a replicated performance test in 1978 (table 9). Pima S-5 and doubled haploids 182 and 195 yielded similarily, and the other five doubled haploids yielded significantly less lint than Pima S-5. Boll and seed properties were variable and generally within acceptable limits, but six doubled haploids had significantly lower lint percent than Pima S-5. All seven doubled haploids had a 2.5-percent span fiber length significantly shorter than Pima S-5. $T_1$ fiber strength and micronaire values were variable and generally acceptable.

Nine doubled haploids, produced via semigamy from $F_1$ male gametes of four crosses, and Pima S-5 were grown in a replicated performance test in 1979 (table 10). Pima S-5 and seven doubled haploids yielded similarly. Doubled haploids 112 and 147 yielded significantly less lint. Doubled haploid 182 was the second highest yielding strain in both the 1978 and 1979 tests, and it also had acceptable boll and fiber properties, showing that a pure line produced via semigamy can compare favorably with a commercial variety. The doubled haploids tested in 1979 performed better as a group than those tested in prior years, indicating that superior pure lines can be identified as more material is evaluated.

No unusual combinations of traits were found in the doubled haploids grown in performance tests. The complete homozygosity of doubled haploids seems to have no deleterious effects. Another study[10] showed that they are sufficiently stable for yield across environments that one or a composite of several could be grown commercially. With few exceptions, the fiber properties of doubled haploids have been inferior to standards in at least one property.

The main advantage of doubled haploids appears to be the ability to obtain homozygous lines from segregating materials in one generation as opposed to the several generations required in the plant-to-row method. However, large numbers of doubled haploids will have to be screened to obtain those with acceptable yield and quality since there is no selection pressure for these traits over a period of years such as in the conventional plant-to-row cultivar improvement method.

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[10] See footnote 6.

# APPENDIX

Table 1.--*Boll and fiber properties of 234 American Pima cotton doubled haploids and checks, Phoenix, Ariz.*

| Doubled haploid number | Number of years tested | Boll size[1] | Seeds per boll | Seed index | Percent lint | Lint index | Fiber length†,‡ | | Length uniformity index | $T_1$ fiber strength | $E_1$ fiber elonga-tion | Micron-aire |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *Grams* | | *Grams* | | *Grams* | --*Millimeters*-- | | | *mN/tex* | *Percent* | |
| 1 | 5 | 3.68 | 19 | 13.0 | 32.3 | 6.2 | 35.1 | 17.3 | 49 | 306 | 8.4 | 3.24 |
| 2 | 5 | 3.56 | 17 | 14.2 | 31.6 | 6.5 | 35.8 | 18.5 | 52 | 340 | 7.0 | 4.23 |
| 3 | 2 | 3.74 | 20 | 12.8 | 31.8 | 6.0 | †34.5 | ‡30.5 | 88 | 300 | -- | 3.94 |
| 4 | 3 | 3.30 | 18 | 11.7 | 33.9 | 6.0 | †34.5 | ‡29.2 | 85 | 281 | 6.8 | 4.77 |
| 5 | 2 | 2.99 | 18 | 11.8 | 30.9 | 5.3 | †35.8 | ‡31.5 | 88 | 310 | -- | 3.18 |
| 6 | 2 | 1.53 | 13 | 12.4 | 31.8 | 6.2 | †32.8 | ‡28.7 | 88 | 313 | -- | 3.05 |
| 7 | 2 | 3.39 | 19 | 12.9 | 27.7 | 5.0 | †34.8 | ‡30.5 | 88 | 308 | -- | 4.25 |
| 8 | 2 | 3.50 | 21 | 11.7 | 30.0 | 5.0 | †37.8 | ‡32.8 | 87 | 300 | -- | 3.49 |
| 9 | 2 | 2.82 | 14 | 14.0 | 31.3 | 6.4 | †35.0 | ‡30.5 | 87 | 284 | -- | 3.62 |
| 10 | 1 | 2.54 | 14 | 13.6 | 27.2 | 5.1 | †36.8 | ‡32.8 | 89 | 318 | -- | 3.45 |
| 11 | 2 | 3.05 | 17 | 12.3 | 32.2 | 5.8 | †36.1 | ‡31.8 | 88 | 314 | -- | 2.99 |
| 12 | 2 | 3.46 | 20 | 11.2 | 35.0 | 6.0 | †33.8 | ‡29.7 | 88 | 314 | -- | 3.35 |
| 13 | 3 | 3.12 | 15 | 13.2 | 34.6 | 7.0 | †37.6 | ‡32.8 | 87 | 313 | 5.8 | 3.99 |
| 14 | 2 | 3.41 | 19 | 12.3 | 33.5 | 6.2 | †35.3 | ‡31.2 | 88 | 328 | 6.9 | 3.52 |
| 15 | 2 | 3.32 | 19 | 12.6 | 29.2 | 5.2 | †37.6 | ‡33.5 | 89 | 320 | -- | 3.10 |
| 16 | 4 | 3.43 | 18 | 12.9 | 30.5 | 5.6 | †36.8 | ‡32.5 | 88 | 320 | 7.6 | 3.48 |
| 17 | 1 | 3.12 | 18 | 11.5 | 32.8 | 5.6 | †36.3 | ‡31.8 | 88 | 286 | -- | 2.95 |
| 18 | 1 | 3.48 | 19 | 13.7 | 27.0 | 5.1 | †37.6 | ‡33.0 | 88 | 331 | 7.5 | 3.44 |
| 19 | 2 | 2.93 | 15 | 13.6 | 30.1 | 5.9 | †38.1 | ‡33.5 | 88 | 320 | 6.5 | 3.46 |
| 20 | 1 | 3.06 | 17 | 12.1 | 31.9 | 5.7 | †35.1 | ‡30.0 | 85 | 304 | 6.5 | 3.36 |
| 21 | 1 | 3.16 | 16 | 14.0 | 26.9 | 5.1 | 38.4 | 19.1 | 50 | 345 | 7.9 | 4.04 |
| 22 | 1 | 2.65 | 14 | 14.4 | 24.1 | 4.6 | †41.9 | ‡37.3 | 89 | 325 | -- | 2.78 |
| 23 | 2 | 3.12 | 18 | 12.2 | 31.0 | 5.5 | †35.3 | ‡30.5 | 86 | 343 | 5.9 | 3.85 |
| 24 | 2 | 3.45 | 19 | 12.3 | 33.8 | 6.0 | 36.1 | 17.8 | 49 | 307 | 8.8 | 3.15 |
| 25 | 3 | 3.58 | 18 | 12.5 | 37.1 | 7.4 | †35.3 | ‡31.0 | 88 | 326 | 7.4 | 3.83 |
| 26 | 3 | 3.57 | 21 | 11.4 | 34.1 | 5.9 | †33.8 | ‡29.5 | 87 | 309 | 7.4 | 3.65 |
| 27 | 3 | 3.25 | 18 | 11.9 | 31.2 | 5.4 | †33.8 | ‡29.9 | 88 | 333 | 7.0 | 3.77 |
| 28 | 2 | 3.09 | 18 | 11.6 | 34.7 | 6.1 | †35.1 | ‡30.2 | 86 | 292 | 6.3 | 3.52 |
| 29 | 3 | 2.89 | 17 | 10.7 | 35.2 | 5.8 | †33.6 | ‡29.3 | 87 | 281 | 6.9 | 3.80 |
| 30 | 2 | 3.51 | 20 | 12.0 | 34.8 | 6.4 | †34.8 | ‡29.7 | 85 | 289 | 7.5 | 3.80 |
| 31 | 1 | 3.95 | 20 | 12.9 | 33.8 | 6.6 | †34.5 | ‡29.7 | 86 | 298 | 6.8 | 3.80 |
| 32 | 2 | 3.11 | 19 | 11.2 | 32.3 | 5.3 | †32.8 | ‡29.0 | 88 | 285 | 6.8 | 3.88 |
| 33 | 1 | 2.56 | 14 | 12.4 | 32.2 | 5.9 | †36.6 | ‡31.5 | 86 | 291 | -- | 3.30 |
| 34 | 2 | 3.75 | 18 | 13.6 | 34.0 | 7.1 | †34.3 | ‡29.7 | 87 | 311 | 6.9 | 3.63 |
| 35 | 1 | 3.60 | 18 | 13.3 | 32.1 | 6.3 | 35.6 | 18.3 | 51 | 305 | 8.4 | 4.15 |
| 36 | 1 | 3.14 | 16 | 13.7 | 31.5 | 6.3 | 36.1 | 17.8 | 49 | 314 | 7.9 | 3.82 |
| 37 | 1 | 3.15 | 18 | 11.8 | 34.0 | 6.1 | †35.1 | ‡30.5 | 87 | 311 | 6.1 | 3.77 |
| 38 | 2 | 3.29 | 18 | 12.8 | 29.4 | 5.3 | †36.1 | ‡31.5 | 87 | 337 | 5.4 | 3.66 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 39 | 2 | 3.41 | 19 | 11.9 | 34.9 | 6.4 | †35.6 | ‡30.7 | 86 | 314 | 6.2 | 3.78 |
| 40 | 1 | 3.72 | 19 | 12.7 | 34.3 | 6.6 | †34.5 | ‡29.7 | 86 | 295 | 6.9 | 3.72 |
| 41 | 2 | 3.28 | 18 | 12.1 | 33.5 | 6.1 | 38.1 | 19.1 | 50 | 309 | 8.4 | 3.50 |
| 42 | 2 | 3.45 | 20 | 12.0 | 32.9 | 5.8 | †34.3 | ‡30.2 | 88 | 311 | 7.2 | 3.58 |
| 43 | 1 | 2.76 | 15 | 11.8 | 33.6 | 6.0 | 35.1 | 16.8 | 48 | 319 | 8.2 | 3.66 |
| 44 | 2 | 2.91 | 17 | 11.4 | 32.4 | 5.5 | †36.3 | ‡31.5 | 87 | 304 | 6.7 | 3.26 |
| 45 | 2 | 3.30 | 19 | 11.9 | 33.0 | 5.9 | †36.3 | ‡31.2 | 86 | 320 | 6.5 | 3.20 |
| 46 | 3 | 2.98 | 19 | 10.1 | 35.1 | 5.5 | †32.5 | ‡28.2 | 87 | 305 | 8.1 | 3.61 |
| 47 | 1 | 3.71 | 19 | 12.8 | 33.1 | 6.3 | †35.6 | ‡30.7 | 86 | 323 | 6.7 | 4.02 |
| 48 | 1 | 3.66 | 18 | 14.2 | 31.1 | 6.4 | 36.3 | 18.3 | 50 | 305 | 7.7 | 3.57 |
| 49 | 2 | 3.47 | 19 | 12.5 | 33.4 | 6.2 | †35.8 | ‡31.0 | 87 | 303 | 6.6 | 3.73 |
| 50 | 2 | 3.64 | 19 | 12.3 | 36.8 | 7.2 | †32.8 | ‡27.9 | 85 | 303 | 6.6 | 4.07 |
| 51 | 2 | 3.02 | 17 | 11.5 | 36.8 | 6.7 | †35.3 | ‡30.5 | 86 | 314 | 7.0 | 3.42 |
| 52 | 2 | 2.99 | 17 | 12.5 | 32.8 | 6.1 | †35.8 | ‡31.0 | 87 | 310 | 6.0 | 3.57 |
| 53 | 2 | 3.25 | 17 | 12.7 | 34.5 | 6.7 | †34.3 | ‡29.7 | 87 | 329 | 6.9 | 3.59 |
| 54 | 1 | 3.72 | 19 | 13.4 | 32.5 | 6.4 | †35.3 | ‡29.5 | 84 | 339 | 6.8 | 3.70 |
| 55 | 1 | 3.33 | 18 | 12.3 | 32.3 | 5.9 | †35.8 | ‡29.0 | 81 | 316 | 6.8 | 4.01 |
| 56 | 1 | 3.35 | 18 | 12.5 | 35.3 | 6.8 | †33.5 | ‡28.4 | 85 | 332 | 6.5 | 3.74 |
| 57 | 1 | 2.96 | 18 | 11.7 | 29.4 | 4.9 | †34.8 | ‡30.7 | 88 | 351 | 5.6 | 3.62 |
| 58 | 1 | 1.62 | 9 | 12.7 | 32.2 | 6.0 | 31.8 | 15.6 | 49 | 348 | 9.0 | 3.22 |
| 59 | 2 | 3.64 | 19 | 13.4 | 29.5 | 5.6 | 37.8 | 18.8 | 50 | 314 | 9.1 | 3.35 |
| 60 | 2 | 2.94 | 16 | 12.5 | 32.4 | 6.0 | 36.3 | 18.5 | 51 | 298 | 8.2 | 3.52 |
| 61 | 1 | 3.63 | 20 | 12.1 | 34.3 | 6.3 | †33.8 | ‡28.7 | 85 | 310 | 6.7 | 3.91 |
| 62 | 2 | 3.10 | 17 | 12.2 | 34.1 | 6.3 | 36.6 | 18.3 | 50 | 323 | 8.7 | 3.71 |
| 63 | 1 | 3.07 | 16 | 12.7 | 35.5 | 7.0 | 34.5 | 17.3 | 50 | 338 | 8.0 | 3.98 |
| 64 | 2 | 3.30 | 18 | 12.3 | 34.1 | 6.4 | 35.8 | 17.0 | 47 | 321 | 8.4 | 3.67 |
| 65 | 1 | 3.76 | 20 | 12.7 | 33.0 | 6.3 | 35.3 | 18.8 | 53 | 342 | 7.5 | 3.81 |
| 66 | 2 | 3.41 | 19 | 12.0 | 34.4 | 6.3 | 36.6 | 17.8 | 49 | 330 | 8.6 | 3.54 |
| 67 | 2 | 2.63 | 14 | 12.8 | 31.2 | 5.8 | 35.8 | 18.3 | 51 | 357 | 7.1 | 3.50 |
| 68 | 1 | 2.93 | 16 | 12.6 | 32.4 | 6.1 | 36.6 | 18.5 | 51 | 319 | 8.0 | 3.64 |
| 69 | 3 | 3.55 | 18 | 12.1 | 37.8 | 7.4 | 36.6 | 17.8 | 49 | 293 | 8.5 | 3.78 |
| 70 | 5 | 3.77 | 19 | 12.8 | 36.1 | 7.2 | 36.1 | 17.8 | 49 | 331 | 7.8 | 3.67 |
| 71 | 1 | 3.68 | 17 | 13.9 | 36.3 | 7.9 | †34.0 | ‡29.7 | 87 | 298 | 7.7 | 4.27 |
| 72 | 2 | 3.45 | 19 | 12.2 | 32.4 | 5.8 | 35.6 | 17.0 | 48 | 351 | 9.0 | 3.89 |
| 73 | 5 | 3.20 | 18 | 11.5 | 35.2 | 6.2 | 35.3 | 17.0 | 48 | 313 | 7.9 | 3.45 |
| 74 | 1 | 2.98 | 17 | 11.4 | 33.4 | 5.7 | 36.3 | 18.0 | 50 | 326 | 6.7 | 3.65 |
| 75 | 1 | 3.64 | 18 | 12.8 | 35.9 | 7.2 | 37.6 | 18.8 | 50 | 310 | 8.0 | 4.00 |
| 76 | 1 | 2.79 | 14 | 13.1 | 34.8 | 7.0 | 34.8 | 17.5 | 50 | 304 | 9.9 | 3.92 |
| 77 | 1 | 3.16 | 15 | 14.7 | 29.4 | 6.1 | 37.8 | 17.8 | 47 | 314 | 8.9 | 3.82 |
| 78 | 2 | 3.79 | 20 | 13.0 | 32.9 | 6.4 | 35.6 | 17.5 | 49 | 305 | 10.2 | 3.56 |
| 79 | 2 | 3.68 | 19 | 13.4 | 32.1 | 6.3 | 36.1 | 17.8 | 49 | 317 | 8.6 | 3.44 |
| 80 | 2 | 2.99 | 16 | 13.7 | 27.4 | 5.2 | 37.6 | 17.8 | 47 | 336 | 8.9 | 3.46 |
| 81 | 3 | 3.17 | 19 | 10.9 | 35.3 | 6.0 | 36.1 | 16.8 | 47 | 287 | 7.4 | 3.81 |
| 82 | 2 | 3.12 | 17 | 12.4 | 33.1 | 6.1 | 35.6 | 17.0 | 48 | 308 | 6.9 | 3.46 |
| 83 | 2 | 2.34 | 13 | 13.4 | 30.3 | 5.8 | 35.1 | 16.5 | 47 | 265 | 7.7 | 3.11 |
| 84 | 2 | 2.79 | 15 | 13.0 | 33.2 | 6.5 | 36.1 | 16.5 | 46 | 285 | 8.4 | 3.29 |
| 85 | 2 | 3.14 | 18 | 11.9 | 33.2 | 5.9 | 36.1 | 17.5 | 48 | 293 | 8.5 | 3.54 |
| 86 | 4 | 3.08 | 17 | 12.4 | 33.6 | 6.3 | 38.1 | 18.3 | 48 | 291 | 8.0 | 3.38 |
| 87 | 2 | 2.97 | 14 | 14.7 | 30.2 | 6.4 | 33.8 | 15.7 | 46 | 272 | 7.9 | 3.05 |

Table 1.--*Boll and fiber properties of 234 American Pima cotton doubled haploids and checks, Phoenix, Ariz.*,--Continued

| Doubled haploid number | Number of years tested | Boll size[1] | Seeds per boll | Seed index | Percent lint | Lint index | Fiber length†,‡ | | Length uniformity index | $T_1$ fiber strength | $E_1$ fiber elonga- tion | Micron- aire |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *Grams* | | *Grams* | | *Grams* | --*Millimeters*-- | | | *mN/tex* | *Percent* | |
| 88 | 2 | 3.16 | 16 | 13.2 | 32.1 | 6.2 | 37.6 | 18.3 | 49 | 265 | 9.2 | 3.62 |
| 89 | 2 | 2.78 | 16 | 12.6 | 29.2 | 5.2 | 38.4 | 18.5 | 48 | 285 | 8.1 | 3.34 |
| 90 | 3 | 2.88 | 15 | 12.9 | 34.1 | 6.7 | 37.3 | 18.5 | 50 | 300 | 7.4 | 3.55 |
| 91 | 2 | 3.14 | 16 | 13.2 | 32.1 | 6.3 | 37.8 | 18.3 | 48 | 302 | 9.1 | 3.51 |
| 92 | 1 | 2.93 | 15 | 13.3 | 31.7 | 6.2 | 37.1 | 18.3 | 49 | 284 | 9.3 | 3.62 |
| 93 | 1 | 3.23 | 17 | 13.0 | 30.7 | 5.8 | 36.1 | 17.8 | 49 | 313 | 8.9 | 3.40 |
| 94 | 1 | 2.73 | 14 | 13.3 | 33.7 | 6.8 | 34.8 | 17.0 | 49 | 302 | 8.1 | 3.61 |
| 95 | 1 | 3.27 | 17 | 12.8 | 35.0 | 6.9 | 35.3 | 17.5 | 50 | 314 | 7.1 | 3.60 |
| 96 | 3 | 2.93 | 15 | 12.9 | 34.5 | 6.7 | 36.3 | 18.5 | 51 | 312 | 8.8 | 3.54 |
| 97 | 2 | 3.04 | 16 | 13.2 | 33.5 | 6.7 | 35.3 | 18.5 | 52 | 322 | 8.7 | 3.59 |
| 98 | 2 | 2.80 | 15 | 12.2 | 35.5 | 6.7 | 35.1 | 18.3 | 52 | 300 | 8.6 | 3.21 |
| 99 | 2 | 3.02 | 15 | 13.0 | 36.7 | 7.5 | 33.0 | 17.3 | 52 | 301 | 8.1 | 3.50 |
| 100 | 2 | 3.20 | 18 | 12.8 | 31.0 | 5.7 | 34.5 | 18.3 | 53 | 308 | 6.4 | 3.96 |
| 101 | 2 | 3.43 | 20 | 10.6 | 37.1 | 6.3 | 31.2 | 16.3 | 52 | 272 | 9.2 | 4.26 |
| 102 | 2 | 3.00 | 20 | 10.9 | 30.1 | 4.7 | 32.8 | 17.3 | 53 | 307 | 9.0 | 3.75 |
| 103 | 5 | 3.03 | 17 | 11.8 | 32.8 | 5.7 | 34.8 | 18.0 | 52 | 303 | 7.8 | 3.54 |
| 104 | 5 | 2.96 | 17 | 11.2 | 34.3 | 5.8 | 33.3 | 16.3 | 49 | 287 | 7.7 | 3.92 |
| 105 | 5 | 3.38 | 18 | 12.0 | 34.9 | 6.5 | 34.5 | 17.3 | 50 | 288 | 8.2 | 3.39 |
| 106 | 3 | 3.09 | 16 | 12.6 | 32.2 | 6.0 | 35.3 | 18.3 | 52 | 299 | 8.5 | 3.55 |
| 107 | 4 | 3.06 | 18 | 12.1 | 30.3 | 5.2 | 34.0 | 17.5 | 51 | 280 | 9.0 | 3.59 |
| 108 | 3 | 3.46 | 19 | 12.0 | 33.7 | 6.1 | 34.8 | 18.0 | 52 | 293 | 9.2 | 3.40 |
| 109 | 5 | 3.21 | 18 | 11.7 | 34.3 | 6.1 | 34.3 | 17.5 | 51 | 293 | 9.1 | 3.70 |
| 110 | 2 | 2.67 | 15 | 12.7 | 32.3 | 6.1 | 34.8 | 18.0 | 52 | 301 | 8.1 | 3.34 |
| 111 | 5 | 2.74 | 15 | 12.2 | 33.3 | 6.1 | 33.0 | 16.5 | 50 | 284 | 8.0 | 3.71 |
| 112 | 4 | 2.99 | 17 | 12.4 | 31.4 | 5.7 | 34.8 | 17.8 | 51 | 308 | 7.6 | 3.47 |
| 113 | 5 | 2.92 | 16 | 12.1 | 32.5 | 5.8 | 34.5 | 18.0 | 52 | 320 | 8.2 | 3.87 |
| 114 | 2 | 2.66 | 14 | 13.3 | 31.5 | 6.1 | 35.1 | 17.8 | 51 | 282 | 10.2 | 3.18 |
| 115 | 2 | 2.89 | 17 | 11.7 | 33.0 | 5.8 | 33.3 | 17.8 | 53 | 286 | 9.1 | 3.15 |
| 116 | 2 | 2.63 | 15 | 12.3 | 30.3 | 5.4 | 34.8 | 17.0 | 49 | 274 | 9.2 | 3.01 |
| 117 | 2 | 3.40 | 17 | 13.5 | 32.7 | 6.6 | 35.3 | 17.8 | 50 | 273 | 9.8 | 3.19 |
| 118 | 4 | 3.21 | 18 | 12.4 | 33.3 | 6.2 | 35.8 | 17.8 | 50 | 290 | 8.3 | 3.19 |
| 119 | 5 | 3.12 | 17 | 11.8 | 34.9 | 6.3 | 34.8 | 17.3 | 50 | 281 | 8.5 | 3.23 |
| 120 | 3 | 3.04 | 17 | 11.7 | 35.3 | 6.3 | 35.3 | 16.5 | 47 | 277 | 8.0 | 3.46 |
| 121 | 2 | 3.27 | 18 | 11.7 | 36.0 | 6.6 | 33.0 | 16.8 | 51 | 292 | 8.6 | 3.68 |
| 122 | 2 | 3.49 | 19 | 12.2 | 34.4 | 6.4 | 33.5 | 16.0 | 48 | 296 | 7.4 | 3.52 |
| 123 | 1 | 2.86 | 17 | 11.8 | 31.7 | 5.5 | 35.6 | 17.5 | 49 | 349 | 7.3 | 3.62 |
| 124 | 1 | 3.31 | 20 | 11.4 | 30.8 | 5.1 | 36.1 | 18.3 | 51 | 298 | 9.0 | 3.35 |
| 125 | 1 | 2.89 | 17 | 11.1 | 33.8 | 5.7 | 34.8 | 17.0 | 49 | 287 | 8.7 | 3.37 |
| 126 | 2 | 2.52 | 16 | 10.9 | 33.8 | 5.6 | 34.0 | 17.0 | 50 | 303 | 7.8 | 3.21 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 127 | 1 | 2.30 | 13 | 12.3 | 29.9 | 6.3 | 36.6 | 18.8 | 51 | 302 | 8.4 | 3.00 |
| 128 | 3 | 3.57 | 20 | 11.6 | 35.3 | 6.3 | 34.0 | 16.3 | 48 | 281 | 8.8 | 3.48 |
| 129 | 1 | 4.01 | 20 | 12.8 | 35.6 | 7.1 | 33.8 | 17.8 | 53 | 316 | 8.3 | 3.73 |
| 130 | 4 | 3.28 | 17 | 13.0 | 32.2 | 6.2 | 34.5 | 16.8 | 49 | 294 | 7.5 | 3.47 |
| 131 | 3 | 2.82 | 15 | 11.7 | 35.6 | 6.5 | 32.0 | 14.7 | 46 | 292 | 7.5 | 3.55 |
| 132 | 4 | 2.96 | 18 | 10.9 | 35.2 | 5.9 | 33.3 | 17.3 | 52 | 322 | 8.3 | 3.70 |
| 133 | 2 | 3.34 | 19 | 11.9 | 33.6 | 6.0 | 34.3 | 15.7 | 46 | 290 | 7.9 | 3.68 |
| 134 | 1 | 3.77 | 20 | 12.6 | 32.1 | 6.0 | 35.3 | 17.3 | 49 | 320 | 7.6 | 3.28 |
| 135 | 1 | 3.51 | 20 | 11.6 | 34.5 | 6.1 | 34.3 | 17.5 | 51 | 288 | 10.2 | 3.60 |
| 136 | 1 | 3.29 | 19 | 12.0 | 29.5 | 5.0 | 34.8 | 17.0 | 49 | 307 | 6.9 | 3.36 |
| 137 | 2 | 2.94 | 18 | 11.2 | 32.2 | 5.3 | 34.0 | 16.0 | 47 | 277 | 8.8 | 3.59 |
| 138 | 1 | 2.73 | 16 | 11.4 | 31.0 | 5.1 | 36.8 | 17.0 | 46 | 286 | 7.4 | 3.17 |
| 139 | 1 | 3.10 | 17 | 12.8 | 31.7 | 5.9 | 37.6 | 18.3 | 49 | 291 | 8.9 | 3.35 |
| 140 | 1 | 2.52 | 13 | 13.0 | 30.7 | 5.8 | 33.3 | 17.5 | 53 | 292 | 10.2 | 3.80 |
| 141 | 4 | 3.24 | 19 | 10.9 | 35.8 | 6.0 | 33.0 | 16.8 | 51 | 308 | 9.1 | 3.95 |
| 142 | 4 | 3.32 | 19 | 11.2 | 35.8 | 6.2 | 33.8 | 16.8 | 50 | 299 | 8.2 | 3.69 |
| 143 | 3 | 3.39 | 17 | 13.4 | 34.1 | 6.9 | 36.1 | 17.3 | 48 | 305 | 9.0 | 3.61 |
| 144 | 4 | 2.86 | 18 | 10.6 | 34.2 | 5.5 | 33.5 | 16.5 | 49 | 291 | 8.2 | 3.67 |
| 145 | 2 | 2.82 | 16 | 11.5 | 33.7 | 5.8 | 33.0 | 17.0 | 52 | 298 | 9.0 | 3.60 |
| 146 | 3 | 3.31 | 18 | 12.0 | 33.2 | 5.9 | 34.5 | 17.8 | 52 | 309 | 7.4 | 3.60 |
| 147 | 2 | 2.87 | 17 | 11.5 | 32.3 | 5.5 | 35.8 | 18.3 | 51 | 347 | 7.5 | 3.62 |
| 148 | 4 | 3.45 | 20 | 11.9 | 32.9 | 5.9 | 34.0 | 17.3 | 51 | 306 | 8.3 | 3.63 |
| 149 | 4 | 3.06 | 16 | 11.8 | 36.5 | 6.8 | 33.8 | 17.0 | 50 | 295 | 9.2 | 3.72 |
| 150 | 2 | 2.91 | 17 | 11.0 | 36.1 | 6.2 | 33.3 | 16.3 | 49 | 266 | 8.2 | 3.49 |
| 151 | 4 | 3.40 | 17 | 13.1 | 33.1 | 6.5 | 34.0 | 16.8 | 49 | 304 | 8.2 | 3.35 |
| 152 | 3 | 3.13 | 18 | 11.6 | 34.0 | 6.0 | 34.0 | 16.3 | 48 | 279 | 7.9 | 3.61 |
| 153 | 1 | 2.27 | 12 | 13.5 | 29.4 | 5.6 | 34.8 | 17.5 | 50 | 297 | 8.2 | 3.56 |
| 154 | 4 | 3.05 | 18 | 11.2 | 35.0 | 6.0 | 33.5 | 17.5 | 52 | 299 | 8.8 | 3.59 |
| 155 | 3 | 3.36 | 18 | 13.1 | 30.9 | 5.9 | 34.0 | 17.5 | 51 | 267 | 8.2 | 3.57 |
| 156 | 4 | 3.01 | 17 | 11.7 | 35.6 | 6.4 | 32.5 | 15.5 | 48 | 257 | 8.3 | 3.67 |
| 157 | 2 | 3.22 | 20 | 11.7 | 29.3 | 4.9 | 35.8 | 18.0 | 50 | 297 | 7.0 | 3.50 |
| 158 | 3 | 3.02 | 18 | 11.5 | 32.2 | 5.5 | 33.8 | 17.0 | 50 | 271 | 9.2 | 3.71 |
| 159 | 4 | 3.14 | 17 | 11.9 | 35.6 | 6.6 | 33.0 | 16.5 | 50 | 274 | 9.5 | 4.09 |
| 160 | 4 | 3.40 | 17 | 12.6 | 35.9 | 7.0 | 33.8 | 17.0 | 50 | 305 | 7.3 | 4.05 |
| 161 | 2 | 3.52 | 19 | 12.9 | 31.2 | 5.9 | 35.1 | 17.3 | 49 | 276 | 8.8 | 3.69 |
| 162 | 3 | 2.90 | 18 | 11.1 | 33.1 | 5.5 | 33.8 | 17.5 | 52 | 312 | 8.7 | 3.60 |
| 163 | 3 | 2.72 | 16 | 11.6 | 32.8 | 5.6 | 35.8 | 17.5 | 49 | 308 | 7.9 | 3.45 |
| 164 | 1 | 2.55 | 14 | 13.2 | 28.3 | 5.2 | 36.8 | 19.1 | 52 | 289 | 6.6 | 3.07 |
| 165 | 3 | 3.12 | 16 | 12.3 | 34.9 | 6.6 | 34.3 | 17.8 | 52 | 300 | 8.2 | 3.55 |
| 166 | 2 | 2.78 | 15 | 12.9 | 32.7 | 6.3 | 34.0 | 18.0 | 53 | 282 | 8.7 | 3.59 |
| 167 | 3 | 3.05 | 16 | 12.7 | 34.3 | 6.7 | 34.8 | 18.0 | 52 | 292 | 8.3 | 3.43 |
| 168 | 1 | 2.90 | 16 | 11.7 | 34.5 | 6.1 | 33.0 | 17.5 | 53 | 285 | 7.6 | 3.55 |
| 169 | 2 | 2.98 | 17 | 12.1 | 32.6 | 5.8 | 36.8 | 19.3 | 52 | 314 | 8.5 | 3.60 |
| 170 | 2 | 3.27 | 17 | 13.2 | 32.7 | 6.4 | 35.6 | 18.5 | 52 | 298 | 8.5 | 3.78 |
| 171 | 2 | 4.11 | 20 | 13.6 | 33.1 | 6.7 | 35.8 | 17.3 | 48 | 310 | 8.2 | 3.50 |
| 172 | 1 | 4.34 | 23 | 12.9 | 30.5 | 5.6 | 37.6 | 18.5 | 49 | 332 | 7.4 | 3.52 |
| 173 | 2 | 3.22 | 17 | 12.9 | 33.2 | 6.4 | 35.3 | 17.0 | 48 | 309 | 8.3 | 3.30 |
| 174 | 1 | 4.12 | 23 | 11.9 | 33.0 | 5.9 | 35.8 | 17.0 | 47 | 305 | 7.8 | 3.60 |
| 175 | 1 | 3.17 | 17 | 12.6 | 30.9 | 5.6 | 36.6 | 18.0 | 49 | 326 | 7.1 | 3.45 |

Table 1.--*Boll and fiber properties of 234 American Pima cotton doubled haploids and checks, Phoenix, Ariz.,*--Continued

| Doubled haploid number | Number of years tested | Boll size[1] | Seeds per boll | Seed index | Percent lint | Lint index | Fiber length[†,‡] | | Length uniformity index | $T_1$ fiber strength | $E_1$ fiber elonga- tion | Micron- aire |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *Grams* | | *Grams* | | *Grams* | *--Millimeters--* | | | *mN/tex* | *Percent* | |
| 176 | 1 | 3.11 | 17 | 12.4 | 31.6 | 5.7 | 35.1 | 17.8 | 51 | 341 | 7.2 | 3.35 |
| 177 | 1 | 3.00 | 15 | 13.0 | 33.2 | 6.5 | 36.1 | 17.8 | 49 | 296 | 7.7 | 3.85 |
| 178 | 1 | 3.04 | 16 | 13.1 | 30.1 | 5.7 | 37.3 | 18.3 | 49 | 322 | 7.4 | 3.35 |
| 179 | 2 | 2.66 | 13 | 13.6 | 33.9 | 7.0 | 37.3 | 18.5 | 50 | 295 | 9.1 | 3.45 |
| 180 | 1 | 3.58 | 18 | 13.5 | 31.4 | 6.2 | 38.4 | 19.1 | 50 | 304 | 8.0 | 3.40 |
| 181 | 1 | 3.11 | 17 | 12.6 | 32.1 | 6.0 | 37.1 | 17.5 | 47 | 310 | 7.6 | 3.35 |
| 182 | 4 | 3.18 | 17 | 12.3 | 35.7 | 6.8 | 34.8 | 17.3 | 50 | 312 | 7.6 | 3.54 |
| 183 | 2 | 3.03 | 17 | 12.5 | 32.6 | 6.0 | 36.3 | 18.3 | 50 | 313 | 7.7 | 3.73 |
| 184 | 4 | 3.08 | 17 | 12.4 | 33.5 | 6.2 | 34.5 | 17.3 | 50 | 312 | 8.2 | 3.69 |
| 185 | 4 | 3.21 | 16 | 13.8 | 33.2 | 6.8 | 36.6 | 18.3 | 50 | 316 | 7.8 | 3.58 |
| 186 | 4 | 3.14 | 17 | 12.5 | 33.4 | 6.3 | 36.1 | 17.5 | 48 | 293 | 7.8 | 3.35 |
| 187 | 4 | 3.27 | 19 | 11.0 | 37.3 | 6.6 | 34.3 | 16.5 | 48 | 294 | 7.5 | 3.98 |
| 188 | 1 | 4.20 | 23 | 12.2 | 32.5 | 5.9 | 37.1 | 18.5 | 50 | 322 | 6.7 | 3.35 |
| 189 | 3 | 3.40 | 17 | 13.2 | 34.4 | 7.0 | 35.3 | 17.3 | 49 | 303 | 8.4 | 3.52 |
| 190 | 3 | 3.66 | 19 | 12.9 | 33.3 | 6.5 | 34.5 | 16.5 | 48 | 303 | 8.2 | 3.30 |
| 191 | 3 | 3.16 | 18 | 11.8 | 31.8 | 5.5 | 34.8 | 17.8 | 51 | 314 | 7.8 | 3.62 |
| 192 | 4 | 3.46 | 19 | 12.3 | 33.3 | 6.1 | 35.8 | 18.5 | 52 | 338 | 7.3 | 3.50 |
| 193 | 3 | 3.46 | 18 | 12.7 | 32.5 | 6.2 | 34.3 | 17.8 | 52 | 307 | 8.4 | 3.81 |
| 194 | 1 | 3.37 | 19 | 11.9 | 33.7 | 6.0 | 36.8 | 17.8 | 48 | 304 | 7.3 | 3.60 |
| 195 | 4 | 3.29 | 18 | 12.1 | 34.5 | 6.4 | 33.8 | 17.0 | 50 | 311 | 7.8 | 3.84 |
| 196 | 1 | 3.25 | 18 | 11.9 | 32.1 | 5.6 | 36.1 | 18.0 | 50 | 302 | 7.9 | 3.60 |
| 197 | 1 | 3.20 | 18 | 11.5 | 36.0 | 6.5 | 35.3 | 16.8 | 48 | 304 | 6.6 | 3.75 |
| 198 | 4 | 3.20 | 17 | 12.1 | 35.6 | 6.7 | 35.3 | 17.0 | 48 | 324 | 7.2 | 3.74 |
| 199 | 1 | 3.04 | 17 | 12.2 | 31.3 | 5.5 | 37.3 | 18.5 | 50 | 319 | 7.3 | 3.40 |
| 200 | 1 | 3.10 | 17 | 12.1 | 34.7 | 6.4 | 35.8 | 17.5 | 49 | 310 | 7.1 | 3.80 |
| 201 | 4 | 3.37 | 18 | 12.6 | 33.7 | 6.4 | 35.3 | 17.5 | 50 | 317 | 7.7 | 3.28 |
| 202 | 1 | 3.42 | 17 | 13.3 | 32.6 | 6.4 | 37.1 | 18.5 | 50 | 320 | 7.9 | 3.80 |
| 203 | 3 | 3.29 | 18 | 11.7 | 33.8 | 6.0 | 34.8 | 17.5 | 50 | 297 | 8.3 | 3.84 |
| 204 | 3 | 3.24 | 18 | 12.1 | 34.1 | 6.3 | 35.1 | 17.3 | 49 | 291 | 7.8 | 3.61 |
| 205 | 1 | 3.18 | 17 | 12.8 | 33.0 | 6.3 | 37.6 | 18.8 | 50 | 343 | 7.0 | 3.75 |
| 206 | 1 | 2.69 | 15 | 11.4 | 34.2 | 5.9 | 35.6 | 17.3 | 49 | 322 | 7.6 | 3.85 |
| 207 | 1 | 2.54 | 13 | 13.1 | 31.5 | 6.0 | 37.8 | 17.8 | 47 | 331 | 7.2 | 3.48 |
| 208 | 2 | 3.29 | 17 | 12.5 | 36.3 | 7.2 | 33.0 | 16.5 | 50 | 287 | 8.5 | 3.44 |
| 209 | 1 | 3.24 | 16 | 12.8 | 35.4 | 7.0 | 35.1 | 18.0 | 51 | 305 | 7.5 | 3.50 |
| 210 | 1 | 3.50 | 19 | 13.2 | 30.1 | 5.7 | 35.6 | 17.8 | 50 | 307 | 7.9 | 3.55 |
| 211 | 1 | 4.45 | 24 | 13.0 | 29.4 | 5.4 | 37.1 | 18.8 | 51 | 331 | 6.8 | 3.40 |
| 212 | 1 | 3.42 | 18 | 12.9 | 31.1 | 5.8 | 36.3 | 17.8 | 49 | 305 | 7.0 | 3.85 |
| 213 | 1 | 3.34 | 18 | 13.2 | 30.2 | 5.7 | 37.8 | 19.1 | 51 | 334 | 7.9 | 3.32 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 214 | 1 | 2.70 | 14 | 13.7 | 29.5 | 5.7 | 34.3 | 18.0 | 52 | 293 | 9.5 | 3.60 |
| 215 | 1 | 3.03 | 17 | 12.3 | 31.2 | 5.6 | 35.8 | 17.5 | 49 | 314 | 8.1 | 3.40 |
| 216 | 1 | 2.98 | 16 | 12.4 | 31.4 | 5.7 | 36.3 | 17.5 | 48 | 319 | 8.0 | 3.35 |
| 217 | 1 | 2.74 | 16 | 12.1 | 31.1 | 5.5 | 34.3 | 17.0 | 50 | 311 | 7.4 | 3.46 |
| 218 | 1 | 3.15 | 17 | 12.3 | 32.4 | 5.9 | 35.3 | 16.5 | 47 | 313 | 7.7 | 3.37 |
| 219 | 1 | 2.85 | 15 | 13.3 | 31.5 | 6.1 | 36.8 | 17.8 | 48 | 325 | 8.1 | 3.08 |
| 220 | 1 | 2.81 | 14 | 13.3 | 32.3 | 6.4 | 38.4 | 18.8 | 49 | 307 | 8.1 | 3.65 |
| 221 | 1 | 2.92 | 15 | 13.4 | 31.4 | 6.1 | 37.3 | 18.5 | 50 | 323 | 7.7 | 3.64 |
| 222 | 1 | 3.05 | 15 | 13.2 | 33.4 | 6.6 | 36.8 | 18.3 | 50 | 316 | 7.3 | 3.44 |
| 223 | 1 | 2.81 | 15 | 13.3 | 31.1 | 6.0 | 36.6 | 17.8 | 49 | 311 | 7.3 | 3.50 |
| 224 | 1 | 3.56 | 17 | 13.9 | 32.9 | 6.8 | 37.1 | 18.5 | 50 | 319 | 8.4 | 3.52 |
| 225 | 1 | 3.16 | 16 | 13.5 | 31.3 | 6.1 | 36.3 | 17.0 | 47 | 316 | 7.5 | 3.08 |
| 226 | 1 | 3.23 | 18 | 11.8 | 33.9 | 6.1 | 36.6 | 18.5 | 51 | 311 | 7.1 | 3.40 |
| 227 | 1 | 2.63 | 15 | 12.6 | 29.8 | 5.3 | 36.3 | 18.0 | 50 | 317 | 7.7 | 3.02 |
| 228 | 1 | 3.45 | 17 | 13.3 | 34.2 | 6.9 | 34.5 | 16.3 | 47 | 311 | 7.9 | 3.80 |
| 229 | 1 | 3.34 | 18 | 12.6 | 32.7 | 6.1 | 36.8 | 17.8 | 48 | 308 | 7.8 | 3.15 |
| 230 | 1 | 3.64 | 21 | 12.4 | 29.0 | 5.1 | 36.6 | 18.3 | 50 | 293 | 8.7 | 3.27 |
| 231 | 1 | 2.49 | 15 | 12.0 | 27.5 | 4.5 | 38.4 | 18.3 | 48 | 291 | 8.4 | 2.72 |
| 232 | 1 | 2.94 | 16 | 11.7 | 35.9 | 6.6 | 34.8 | 17.3 | 50 | 322 | 8.7 | 3.97 |
| 233 | 1 | 2.52 | 13 | 12.9 | 32.1 | 6.1 | 37.6 | 18.3 | 49 | 331 | 7.5 | 3.47 |
| 234 | 1 | 2.56 | 15 | 11.0 | 34.0 | 5.7 | 35.8 | 17.3 | 48 | 322 | 7.9 | 3.50 |
| Pima S-2 | 2 | | | | | | †33.8 | ‡29.0 | 86 | | | |
| Pima S-2 | 7 | | | | | | 34.0 | 16.5 | 49 | 298 | 8.5 | 3.66 |
| Pima S-5 | 6 | 3.34 | 18 | 12.2 | 35.5 | 6.8 | 35.6 | 17.8 | 50 | 303 | 7.9 | 3.70 |

Note: Dashes indicate no data.

†Indicates fiber length in first column is upper-half mean length; no symbol indicates 2.5-percent span fiber length.

‡Indicates fiber length in second column is mean length; no symbol indicates 50-percent span fiber length.

[1]Value for each trait is an average when tested for more than 1 year.

Table 2.--*Pedigrees and identification numbers in each for 234 American Pima cotton doubled haploids*

| Pedigree | Doubled haploid identification No. |
|---|---|
| Pima S-1 | 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 14, 16, 18, 26, 51, 58, 79, 80 |
| Pima S-2 | 28, 29, 30, 31, 32, 50, 53, 56, 60, 61, 62, 63, 64, 65, 66, 68, 82, 165, 166, 167, 168 |
| Pima S-4 | 84, 90, 91, 92 |
| (3-79 X S1) 22-5 | 17, 27, 33, 34, 35, 36, 37, 38, 39, 40, 47, 48, 52 |
| (3-79 X S1) 22-6 | 20, 41, 42, 43, 44, 45, 46 |
| 3-79 | 19, 93, 164 |
| (SSI X W245-4) 227-1015 | 4 |
| [(3-79 X S1) 22-12] X [SSI] 94-608 | 13 |
| (W245-4 X 1-71) 1000-28-680 | 15 |
| (SSI X W245-4 X SSI) 1003 | 21 |
| (435-12) X (717-2) $F_2$ | 22 |
| [(P32 X S1) 6-2-16] X [(3-79 X S1) 22-12-22] $F_2$ | 23 |
| *G. barbadense* + *G. hirsutum* mixture | 24 |
| (3-79 X S1 X S1) 127-678-295 | 25 |
| [(P32 X S1) 1-10] X [(3-79 X S1) 22-12] 289 | 54 |
| 5714-2 $F_3$ | 55 |
| (SSI X W245-4 X SSI) 1008-520 | 57 |
| 1959 mass cross | 59 |
| B59-3193 (1048A) | 67 |
| (3-79 X S1 X S1) 127-680-301-310 | 69 |

Table 2.--*Pedigrees and identification numbers in each for 234 American Pima cotton doubled haploids*--Continued

| Pedigree | Doubled haploid identification No. |
|---|---|
| (3-79 X S1 X S1) 128-684-192 | 70 |
| 5714-63-1 $F_4$ | 71 |
| 5714-36-2 $F_4$ | 72 |
| 5720-42-5 $F_4$ | 73 |
| 5806-40 $F_3$ | 74 |
| 5814-5 $F_3$ | 75 |
| 5902 $F_2$ | 76, 89 |
| 5910 $F_2$ | 77 |
| 5913 $F_2$ | 78 |
| 6079 $F_2$ | 81 |
| 5815-99-1 $F_4$ | 83 |
| 6001-84-2 $F_4$ | 85 |
| 6002-26-2-5-4 $F_6$ | 86 |
| 6507 $F_2$ | 87 |
| 5916-15-4-2-4 $F_6$ | 88 |
| 6604-70-5-5 $F_5$ | 94 |
| 6803-10 $F_3$ | 95 |
| 66168-111-5-6 $F_5$ | 96 |
| 6806 $F_2$ | 97 |
| 6809 $F_2$ | 98 |
| 6812 $F_2$ | 99 |
| (Pima S-3 X Pima S-4) $F_1$ | 100, 101, 102, 161, 162, 163, 169, 170 |

Table 2.--*Pedigrees and identification numbers in each for 234 American Pima cotton doubled haploids*--Continued

| Pedigree | Doubled haploid identification No. |
|---|---|
| 6907 $F_1$ | 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 208 |
| 6910 $F_1$ | 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, |
| 7101 $F_1$ | 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 211, 212, 213, 218, 219, 220, 221, 222, 223, 224 |
| 7106 $F_1$ | 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 214, 215, 216, 217, 225, 226, 227, 228, 229, 230, 231 |
| 7202 $F_1$ | 205, 206, 207, 232, 233, 234 |
| 7301 $F_1$ | 209, 210 |

Table 3.--*A list of traits and 5 to 8 outstanding doubled haploids for each*

| Trait | Doubled haploid identification No. |
|---|---|
| Boll size (g/boll) | 171, 172, 174, 188, 211 |
| Seeds per boll | 8, 26, 172, 174, 188, 211, 230 |
| Seed index | 2, 22, 48, 77, 87 |
| Percent lint | 25, 50, 51, 69, 101, 187 |
| Lint index | 25, 50, 69, 70, 71, 75, 99, 208 |
| 2.5-percent span fiber length | 21, 89, 180, 220, 231 |
| 50-percent span fiber length | 21, 41, 164, 169, 180, 213 |
| $T_1$ fiber strength | 57, 58, 67, 72, 123, 147 |
| $E_1$ fiber elongation | 76, 78, 114, 135, 140 |
| Micronaire | 2, 4, 7, 71, 101 |

Table 4.--*Yield, boll, and fiber properties of 9 Pima cotton doubled haploids and Pima S-2, Phoenix, Ariz., 1961*

| Doubled haploid number or cultivar | Lint yield | Boll size | Seeds per boll | Seed index | Percent lint | Lint index | Fiber length: Upper half mean | Fiber length: Mean | $T_1$ fiber strength | Micro-naire |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Kg/ha* | *Grams* | *Number* | *Grams* | | *Grams* | *--Millimeters--* | | *mN/tex* | |
| 4 | 1,133 | 2.75 | 16 | 11.5 | 33.7 | 5.9 | 35.1 | 30.2 | 269 | 4.86 |
| 17 | 998 | 3.02 | 17 | 11.5 | 33.4 | 5.8 | 35.8 | 31.5 | 286 | 3.60 |
| Pima S-2 | 980 | 3.02 | 16 | 11.8 | 35.6 | 6.5 | 35.6 | 31.0 | 293 | 3.82 |
| 16 | 914 | 3.34 | 18 | 12.4 | 32.1 | 5.8 | 36.7 | 32.5 | 301 | 3.51 |
| 3 | 830 | 3.39 | 18 | 13.1 | 32.2 | 6.2 | 34.0 | 30.0 | 288 | 4.06 |
| 11 | 800 | 3.06 | 17 | 12.1 | 32.7 | 5.9 | 35.3 | 31.2 | 285 | 3.48 |
| 1 | 798 | 3.02 | 16 | 13.0 | 30.8 | 5.8 | 34.8 | 30.7 | 296 | 3.29 |
| 5 | 749 | 3.00 | 16 | 12.9 | 31.2 | 5.8 | 36.6 | 32.8 | 295 | 3.42 |
| 10 | 697 | 2.85 | 15 | 13.8 | 28.4 | 5.5 | 36.8 | 33.0 | 301 | 3.68 |
| 15 | 683 | 3.22 | 17 | 13.6 | 29.5 | 5.7 | 36.8 | 33.0 | 302 | 3.50 |
| L.S.D. 0.05 | 72 | .20 | 1 | .4 | .9 | .3 | .5 | .8 | 7 | .15 |

Table 5.--*Yield, boll, and fiber properties of 11 Pima cotton doubled haploids and Pima S-2, Phoenix, Ariz., 1962*

| Doubled haploid number or cultivar | Lint yield | Boll size | Seeds per boll | Seed index | Percent lint | Lint index | Fiber length: Upper half mean | Fiber length: Mean | $T_1$ fiber strength | $E_1$ fiber elongation | Micronaire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Kg/ha* | *Grams* | *Number* | *Grams* | | *Grams* | --*Millimeters*-- | | *mN/tex* | *Percent* | |
| 13 | 1,276 | 3.22 | 16 | 13.5 | 33.4 | 6.8 | 37.8 | 33.3 | 305 | 5.8 | 3.79 |
| 4 | 1,238 | 3.22 | 19 | 11.8 | 32.4 | 5.6 | 35.1 | 30.2 | 285 | 6.6 | 4.41 |
| 30 | 1,225 | 3.60 | 19 | 12.8 | 33.5 | 6.5 | 35.8 | 31.0 | 290 | 7.0 | 3.57 |
| 25 | 1,199 | 3.60 | 18 | 13.1 | 35.1 | 7.1 | 36.3 | 31.8 | 320 | 6.9 | 3.59 |
| 23 | 1,151 | 3.60 | 19 | 12.9 | 30.4 | 5.7 | 36.1 | 31.2 | 328 | 6.0 | 3.50 |
| 44 | 1,085 | 3.04 | 18 | 11.9 | 30.8 | 5.3 | 36.8 | 32.0 | 301 | 6.5 | 3.05 |
| 34 | 1,075 | 3.75 | 18 | 14.2 | 32.5 | 6.8 | 35.8 | 31.2 | 305 | 6.9 | 3.40 |
| 32 | 1,060 | 3.45 | 18 | 12.8 | 31.1 | 5.8 | 34.8 | 30.5 | 295 | 6.9 | 3.79 |
| Pima S-2 | 1,048 | 3.29 | 17 | 12.5 | 34.2 | 6.5 | 35.6 | 30.7 | 307 | 6.6 | 3.44 |
| 29 | 1,009 | 3.13 | 18 | 11.7 | 34.3 | 6.1 | 34.8 | 30.7 | 292 | 6.6 | 3.41 |
| 46 | 984 | 3.24 | 19 | 11.5 | 33.1 | 5.7 | 34.8 | 30.7 | 310 | 7.0 | 3.52 |
| 22 | 796 | 3.60 | 17 | 14.9 | 27.9 | 5.8 | 39.9 | 35.6 | 320 | 6.9 | 3.10 |
| L.S.D. 0.05 | 157 | .17 | 1 | .5 | .7 | .3 | .8 | .8 | 9 | .3 | .13 |

Table 6.--*Yield, boll, and fiber properties of 7 Pima cotton doubled haploids and Pima S-2, Phoenix, Ariz., 1963*

| Doubled haploid number or cultivar | Lint yield | Boll size | Seeds per boll | Seed index | Percent lint | Lint index | Fiber length: Upper half mean | Fiber length: Mean | $T_1$ fiber strength | $E_1$ fiber elonga-tion | Micro-naire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Kg/ha* | *Grams* | *Number* | *Grams* | | *Grams* | *--Millimeters--* | | *mN/tex* | *Percent* | |
| 50 | 784 | 3.66 | 18 | 12.0 | 37.1 | 7.1 | 32.0 | 27.4 | 294 | 7.4 | 4.14 |
| 28 | 760 | 3.51 | 19 | 11.7 | 35.1 | 6.3 | 33.5 | 28.4 | 277 | 7.3 | 3.85 |
| 62 | 750 | 3.62 | 20 | 12.1 | 35.2 | 6.6 | 33.5 | 28.7 | 280 | 7.5 | 3.94 |
| 53 | 743 | 3.60 | 19 | 12.2 | 35.2 | 6.7 | 32.8 | 27.7 | 301 | 7.7 | 3.90 |
| 44 | 711 | 3.35 | 19 | 11.8 | 32.8 | 5.8 | 34.5 | 29.5 | 284 | 7.5 | 3.69 |
| Pima S-2 | 708 | 3.54 | 19 | 11.7 | 35.5 | 6.5 | 33.5 | 28.4 | 291 | 7.5 | 4.01 |
| 42 | 688 | 3.76 | 21 | 12.3 | 31.8 | 5.7 | 34.3 | 29.7 | 283 | 7.5 | 3.79 |
| 23 | 580 | 3.80 | 21 | 12.2 | 31.1 | 5.5 | 33.8 | 28.4 | 288 | 7.1 | 3.95 |
| L.S.D. 0.05 | 64 | .15 | 1 | .4 | .4 | .2 | .5 | .5 | 13 | NS | .10 |

Table 7.--*Yield, boll, and fiber properties of 2 Pima cotton doubled haploids and Pima S-2, Phoenix, Ariz., 1964*

| Doubled haploid number or cultivar | Lint yield | Boll size | Seeds per boll | Seed index | Percent lint | Lint index | Span fiber length 2.5 percent | Span fiber length 50 percent | $T_1$ fiber strength | $E_1$ fiber elonga-tion | Micro-naire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Kg/ha* | *Grams* | *Number* | *Grams* | | *Grams* | --*Millimeters*-- | | *mN/tex* | *Percent* | |
| 41 | 480 | 3.47 | 18 | 12.7 | 33.2 | 6.3 | 37.6 | 19.0 | 305 | 8.4 | 3.57 |
| 62 | 476 | 3.48 | 18 | 12.7 | 34.1 | 6.6 | 36.3 | 17.8 | 308 | 8.1 | 3.88 |
| Pima S-2 | 508 | 3.65 | 18 | 12.9 | 35.0 | 6.9 | 35.6 | 17.3 | 314 | 8.2 | 3.99 |
| L.S.D. 0.05 | NS | NS | NS | NS | .6 | .3 | .5 | .8 | NS | NS | .12 |

Table 8.--*Yield, boll, and fiber properties of 4 Pima cotton doubled haploids, experimental strain 6907-956-8-4, and Pima S-5, Phoenix, Ariz., 1977*

| Doubled haploid number or cultivar | Lint yield | Boll size | Seeds per boll | Seed index | Percent lint | Lint index | Span fiber length 2.5 percent | Span fiber length 50 percent | $T_1$ fiber strength | $E_1$ fiber elonga-tion | Micro-naire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Kg/ha* | *Grams* | *Number* | *Grams* | | *Grams* | *--Millimeters--* | | *mN/tex* | *Percent* | |
| Pima S-5 | 808 | 3.06 | 16 | 12.6 | 34.5 | 6.6 | 35.1 | 18.3 | 304 | 8.3 | 3.84 |
| 6907-95-8-4 | 725 | 2.65 | 15 | 11.8 | 32.6 | 5.7 | 35.8 | 19.3 | 321 | 8.7 | 4.07 |
| 104 | 725 | 2.75 | 16 | 11.6 | 32.6 | 5.6 | 33.8 | 17.0 | 286 | 7.6 | 3.86 |
| 103 | 665 | 2.80 | 16 | 12.2 | 31.0 | 5.5 | 34.3 | 18.0 | 297 | 7.9 | 3.61 |
| 105 | 623 | 2.87 | 16 | 11.9 | 33.0 | 5.8 | 34.3 | 17.5 | 297 | 8.0 | 3.37 |
| 107 | 501 | 2.84 | 17 | 11.7 | 29.3 | 4.8 | 33.8 | 17.8 | 281 | 8.4 | 3.61 |
| L.S.D. 0.05 | 105 | .11 | 1 | .4 | .5 | .2 | .5 | .8 | 6 | .3 | .08 |

Table 9.--*Yield, boll, and fiber properties of 7 Pima cotton doubled haploids and Pima S-5, Phoenix, Ariz., 1978*

| Doubled haploid number or cultivar | Lint yield | Boll size | Seeds per boll | Seed index | Percent lint | Lint index | Span fiber length: 2.5 percent | Span fiber length: 50 percent | $T_1$ fiber strength | $E_1$ fiber elonga-tion | Micro-naire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Kg/ha* | *Grams* | *Number* | *Grams* | | *Grams* | *--Millimeters--* | | *mN/tex* | *Percent* | |
| Pima S-5 | 1,128 | 3.35 | 18 | 11.8 | 36.7 | 6.9 | 34.3 | 18.3 | 299 | 8.4 | 3.96 |
| 182 | 1,124 | 3.28 | 17 | 12.4 | 36.5 | 7.1 | 33.8 | 17.8 | 313 | 7.4 | 3.82 |
| 195 | 1,080 | 3.27 | 18 | 11.8 | 34.8 | 6.3 | 32.8 | 17.3 | 301 | 8.1 | 4.00 |
| 184 | 943 | 2.95 | 16 | 12.1 | 34.3 | 6.3 | 33.3 | 17.3 | 303 | 8.2 | 3.78 |
| 113 | 886 | 3.16 | 19 | 11.3 | 33.8 | 5.8 | 33.8 | 18.3 | 320 | 7.9 | 4.08 |
| 104 | 791 | 2.92 | 18 | 10.8 | 34.6 | 5.7 | 32.8 | 16.5 | 271 | 7.5 | 3.89 |
| 146 | 773 | 3.35 | 19 | 11.9 | 33.3 | 6.0 | 33.8 | 17.8 | 300 | 7.1 | 3.80 |
| 145 | 771 | 2.95 | 17 | 11.3 | 33.6 | 5.7 | 33.0 | 17.8 | 304 | 8.1 | 3.73 |
| L.S.D. 0.05 | 96 | .13 | 1 | .4 | .4 | .1 | .3 | .5 | 7 | .3 | .07 |

Table 10.--*Yield, boll, and fiber properties of 9 Pima cotton doubled haploids and Pima S-5, Phoenix, Ariz., 1979*

| Doubled haploid number or cultivar | Lint yield | Boll size | Seeds per boll | Seed index | Percent lint | Lint index | Span fiber length 2.5 percent | Span fiber length 50 percent | $T_1$ fiber strength | $E_1$ fiber elonga-tion | Micro-naire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Kg/ha* | *Grams* | *Number* | *Grams* | | *Grams* | --*Millimeters*-- | | *mN/tex* | *Percent* | |
| 187 | 1,146 | 3.22 | 18 | 11.5 | 36.9 | 6.7 | 33.5 | 15.7 | 317 | 8.3 | 3.94 |
| 182 | 1,083 | 3.13 | 17 | 12.0 | 36.7 | 6.9 | 34.5 | 16.8 | 340 | 7.9 | 3.52 |
| 149 | 1,069 | 2.86 | 16 | 11.4 | 36.5 | 6.6 | 34.3 | 17.0 | 323 | 9.6 | 3.66 |
| Pima S-5 | 1,065 | 3.31 | 18 | 11.7 | 37.0 | 6.9 | 34.5 | 16.5 | 323 | 8.8 | 3.74 |
| 203 | 1,034 | 3.14 | 18 | 11.8 | 34.0 | 6.1 | 34.3 | 16.5 | 309 | 8.9 | 3.77 |
| 190 | 985 | 3.13 | 16 | 12.7 | 33.7 | 6.5 | 34.3 | 16.5 | 322 | 9.5 | 3.33 |
| 141 | 955 | 3.03 | 18 | 11.0 | 35.5 | 6.1 | 33.0 | 16.8 | 335 | 9.1 | 4.01 |
| 204 | 946 | 3.08 | 17 | 11.9 | 34.7 | 6.2 | 34.5 | 17.0 | 320 | 9.2 | 3.63 |
| 112 | 810 | 3.00 | 17 | 11.7 | 32.5 | 5.6 | 33.8 | 16.8 | 325 | 7.8 | 3.41 |
| 147 | 806 | 2.75 | 16 | 11.3 | 32.7 | 5.5 | 36.1 | 18.0 | 358 | 8.2 | 3.67 |
| L.S.D. 0.05 | 132 | .14 | 1 | .4 | .6 | .2 | .4 | .4 | 7 | .3 | .10 |

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